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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Woodworking Machinery Lubrication

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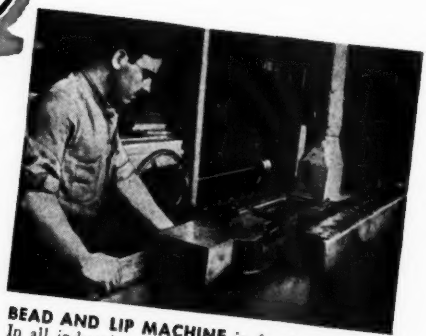

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FOR THE WOODWORKING INDUSTRY

LUBRICATION

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Woodworking Machinery Lubrication

WHEN peace time production exists, woodworking is essentially an art in that it is devoted primarily to the manufacture of furniture and materials for the design and beautifying of the home.

Durability is, of course, an essential, but pleasing appeal from an artistic viewpoint is necessary to ultimate customer acceptance. The industrial requirement for finished wood products is secondary as an income-producing item. Craftsmanship, however, is quite as necessary whether period furniture or intricate shop patterns are being produced. This craftsmanship has been put on a mass production basis by the ingenuity of the woodworking machine designer, the acceptance of the precision ball and roller bearing and the trend towards high speed operations which so facilitate cutting tool performance.

National emergency requirements, however, have somewhat shelved the artistic side of woodworking in favor of the pattern shop. Military equipment has required a wide variety of castings, necessitating patterns of extreme accuracy, sometimes very complex. Only the woodworking craftsman can turn out such patterns. The machinery employed, however, is the same.

We are concerned about this machinery today due to the load which it must carry. Obviously it must function dependably, often more continuously than ever before. Design has planned for this, but operation under overload is a function of maintenance, in turn of lubrication.

Woodworking has been practiced ever since man discovered that certain metals could be sharpened for cutting purposes. The art of fashioning wood into intricate shapes, however, began after the principle of the saw had been perfected. Ever since, the saw has been the primary tool in wood cutting; from the forest, through the sawmill, into the woodworking plant.

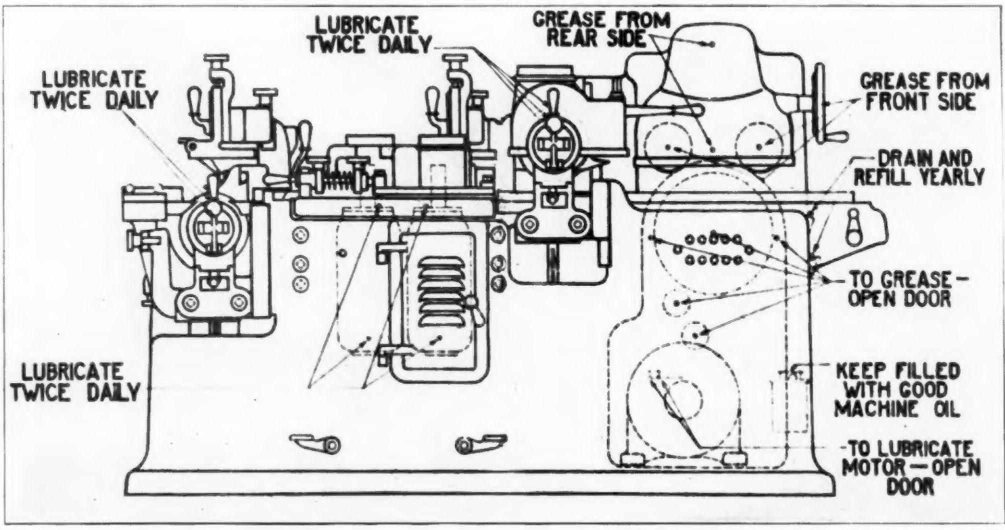
In contrast, as the saw became essential in production cutting of wood materials the woodworking industry then had to revert to the knife-edge for final shaping of wood into useful or ornamental form.

The woodworking industry is noteworthy for the ingenuity of the machine designers who have made its development practicable. As they made use of increased speeds to obtain better cutting their foresight also appreciated the importance of lubrication.

When the industry was going through the development stage, fixed oils of animal or vegetable origin served as comparatively satisfactory lubricants. But this was before the introduction of petroleum, at a time when lard and olive oils were the only products widely available. Later whale oil, tallow, castor and rapeseed oils were also used. Fixed or fatty oils, however, presented a distinct fire hazard due to their tendency to absorb oxygen and cause spontaneous combustion. They were inadequate also for the maintenance of positive and dependable lubrication when machinery builders perfected improved means of lubrication, provided suitable bearing housings and went to higher speeds.

Better means for application of lubricants proved to be excellent insurance against wear and damage to moving parts, for they prevented direct entry of sawdust and other non-lubricating foreign matter. Improved housings pre-

vented premature loss of lubricant through leakage and reduced the fire hazard by eliminating possible accumulation of oil-soaked sawdust or other wood refuse. This meant that a lubricant could function more safely, remain longer in service and in some cases permit of reusage. Directly this imposed an added requirement—the lubricants used must be resistant to break-down, otherwise possible gum formation, oil leakage or soap accumulation might interfere with circulation.



Courtesy of J. A. Fay & Egan Company

Fig. 1—Lubrication chart for an electric molder showing parts to be lubricated and frequency.

Highly refined straight mineral oils are most resistant to breakdown; far more so than animal or vegetable oils, so the latter were used but very little when the petroleum industry had proved itself. Today petroleum oils or greases in which the latter predominate, afford dependable lubrication in the woodworking plant regardless of the speed conditions. Designers of lubricating equipment have naturally kept pace with this development, for any lubricant can only be as dependable as its means of application. Attention has been especially directed to bearing protection in full realization that bearings are usually subjected to the most varying speed conditions, frequently having to carry considerable load under temperatures which may affect the continuity of the lubricating film. Furthermore, bearings are most likely to be affected adversely by presence of non-lubricating foreign matter, such as sawdust or abrasives. This may lead to vibration, especially under high speed operation; vibration is detrimental to perfect cutting.

Bearing design has been a most interesting development. Before discussing it in detail, however, it will be well to review the operation of the machinery essential to the finishing of wood products after the rough materials have left the sawmill. This involves boards, beams or deals. They must be planed, molded or shaped according to the purpose for which the finish is intended. These several processes (after sawing) are the most important in the woodworking industry. The general operation of the machines are more or less similar, and sometimes one machine can be designed to serve several purposes or perform more than one function; for example, planing two or four sides simultaneously.

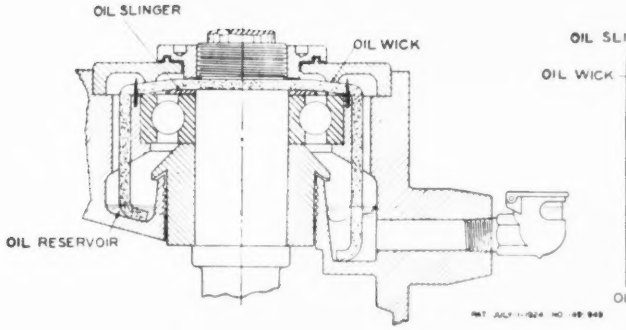
Planing

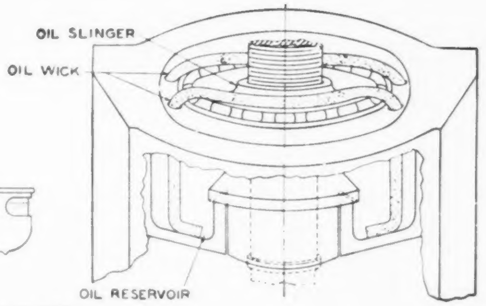
After a board or beam has left the sawmill, it must be smoothed or planed before any subsequent shaping is done. The planer accomplishes this, producing the necessary flat, level and more or less smooth surfaces. This is done by knives or cutting tools with straight edges. They operate continuously along a straight face generally as nearly parallel to the grain of the wood as possible.

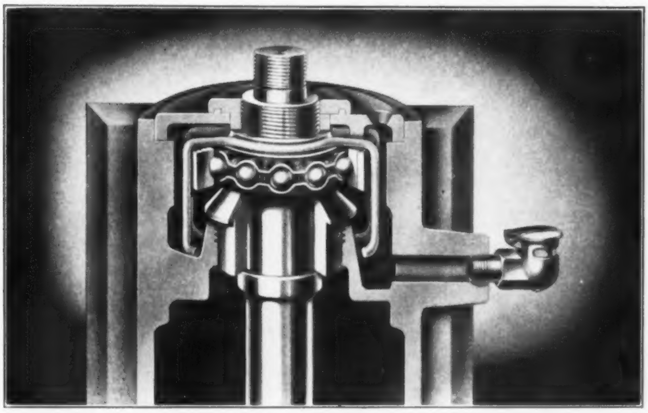
The planer is motor-driven through pulley and belt connections for speed reduction purposes. Most modern construction provides for mounting the spindles, feed rolls and certain other rotating elements on ball or roller bearings, with pressure lubrication wherever practicable. In some respects the planer is akin to the milling machine in the metal working industry, with regard to its working elements.

Lathe Design

Lathe design aroused the interest of the pioneer developers of automatic woodworking

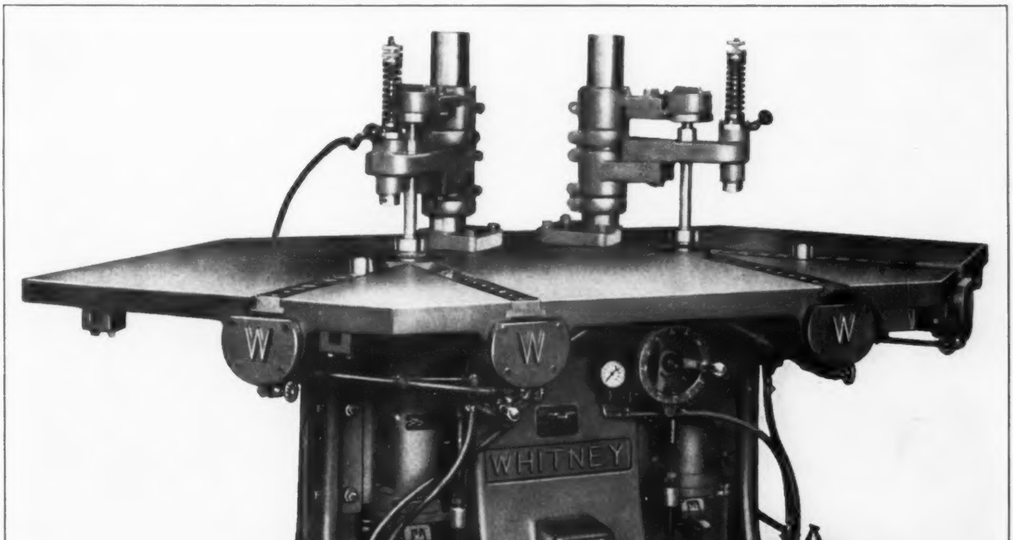




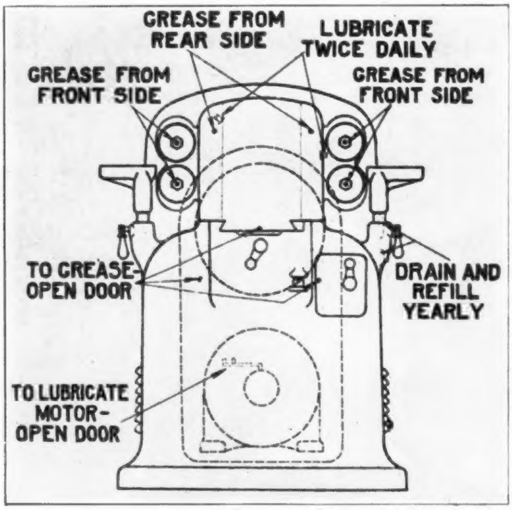


Courtesy of
Baxter D. Whitney & Son, Inc.

Fig. 2—The Whitney direct motor drive electric shaper. Note details of the oil lubrication system above and to the left. Oil is fed by round felt wicks from the reservoir below to slingers which create a fine mist or spray of oil around the bearings. Oil returns provide for recirculation.



machinery due to the versatility of this unit. Its perfection was hastened when it was found to be so adaptable to turning out bobbins and spools for the textile industry, and the wide variety of parts necessary to the building of



Courtesy of J. A. Fay & Egan Company

Fig. 3—Another Fay and Egan lubrication chart—covering a dowel machine, with parts to be lubricated and frequency.

wooden ships when the clipper predominated in our merchant marine trade. For this reason the duty performed by the lathe is of distinct interest.

Technically the lathe is a device designed for production of cylindrical parts of duplicate design. Cutting is accomplished while the stock is turned or rotated, the cutting edge being fixed. The variable speed gears employed on some types of lathes, likewise the spindle bearings which may be subject to comparatively high speeds, may present problems of lubrication especially under more or less continuous service or when temperatures may be extreme. Perfect alignment is, of course, highly essential; in the maintenance of this we are directly concerned with spindle bearing protection and the prevention of undue wear of gear teeth. This is materially assisted by protective lubrication.

Molders and Shapers

The molder is a sort of multiple planer, in that it functions by direct cutting, on a line more or less parallel with the grain of the wood. It is widely used for turning out trim or molding for building purposes. A molder can be designed to cut simultaneously on all four sides of the wood, developing either straight or irregular surfaces according to the desired finish. Cutter head speeds will sometimes be comparatively high, especially where ball bearing mountings are used. This requires careful consideration of lubrication and the use of grease which will resist breakdown and separation.

The shaper is a type of molder which is designed for developing irregular or curved edges along two planes. The work is done by laminated cutters, frequently installed so as to function at an angle to, or across, the grain of the wood. Normally the shaper works on one of three basic principles according to whether the cutters are fixed revolving spindles or holding blocks, carried or fixed in a rotating disc or cross-head, or, where the irons are fixed only, the wood being moved or fed over the cutting edges.

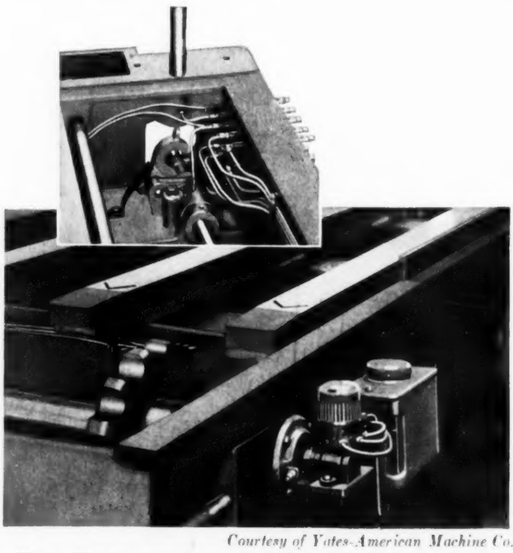
The Mortise and Tenon

Wood products which have been sawed and planed to a true surface must be prepared for joining, when the manufacturer of furniture is involved. The machines employed for this purpose are known as mortisers and tenoners.

The cutting operation in such machines may involve either reciprocating or rotary motion, according to whether the cutting tool or chisel operates intermittently or continuously.

BEARING DESIGN

Bearing design as applied to woodworking



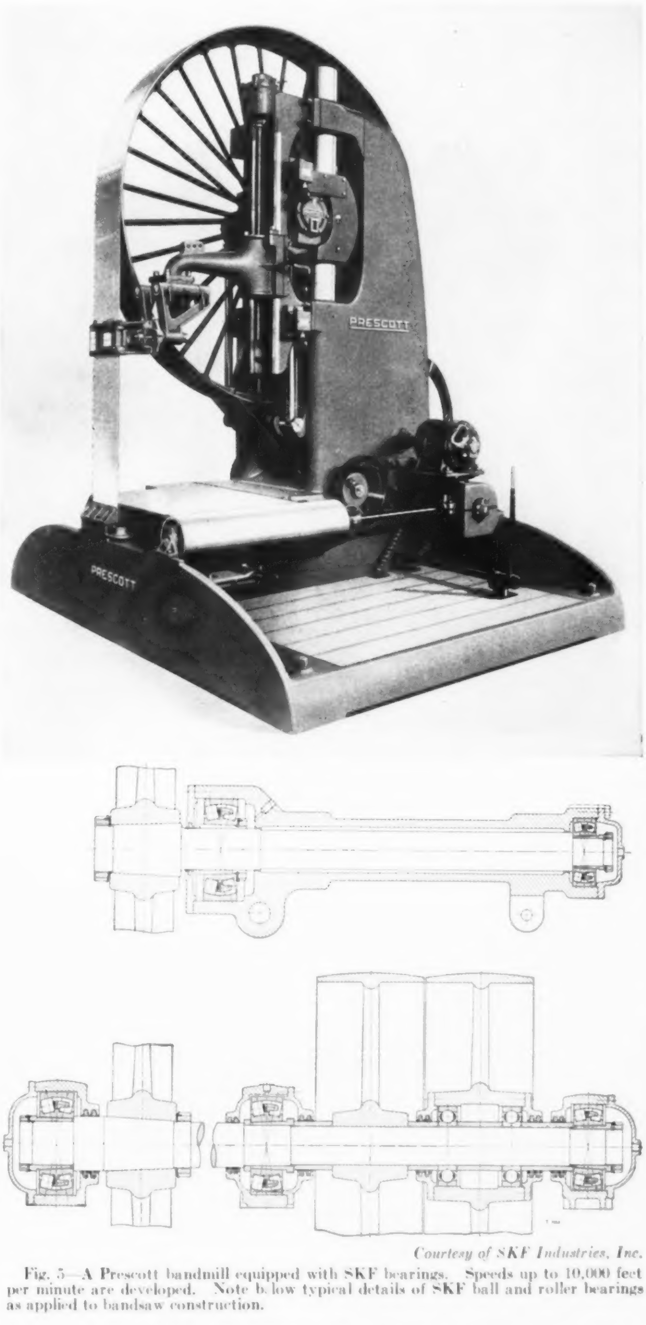
Courtesy of Yates-American Machine Co.

Fig. 4—The bed ways of the Yates-American sander are channeled to receive oil from a force feed lubricator—a separate line to each way insures smooth operation. The insert, in turn, shows one of several groups of fittings by which grease is piped to all bearings.

machinery will depend upon alignment requirements and the speed of the parts involved. High speed requirements have developed widespread interest in the precision ball or roller bearing wherein lubrication is effectually pro-

tected by the bearing seal, and in the needle type bearing. On slower speed mechanisms, however, the unit lubricated sleeve type bearing is quite practicable, and to some preferable due to the low cost factor and the ease with which replacements can be made. Such bearings can be designed for ring oiling, or for servicing by sight feed oilers or pressure grease lubrication.

Speed has been perhaps the most controlling factor which has influenced the trends in bearing design which prevail today. Developments in electric motor design have been partly responsible, including the adaptability of the high speed motor to operation of cutter spindles on molders, shapers and routers. Increase in cutting speeds has enabled the use of cutter heads carrying fewer blades. As an example, some cutter heads today carry only one blade, as compared with older types which required from four to eight blades. Increased speeds also permit of finer cutting. This reduces initial cost which is an advantage when knives of intricate design are used; also, the labor incident to re-sharpening is decreased, permitting assignment of men to other work. All this leads to increased production. As a result of the research devoted to the study of high speed operations, spindle speeds approaching 20,000 R.P.M. are practicable. Beneficial results can only be assured, however, if vibration is controlled and not allowed to develop to excess. Proper lubrication is very helpful in this regard.



Courtesy of SKF Industries, Inc.

Fig. 5—A Prescott bandmill equipped with SKF bearings. Speeds up to 10,000 feet per minute are developed. Note below typical details of SKF ball and roller bearings as applied to bandsaw construction.

Planer and Surfacer Bearings

On such equipment there is a rapidly increasing tendency to provide ball bearings for all knife head or cutting elements. Incidentally, these parts rotate at comparatively high speed, varying from 3,000 to 7,000 R.P.M., according to the design of the machine. In contrast, however, the plain or sleeve type bearing is chiefly used for shafting of guide rollers or similar elements where load conditions are normal.

Saw Design Has Also Been Studied

Normally the band, swing or circular saw is a comparatively high speed device. In the band saw, motion is imparted by an upper and lower disc or wheel. Around these elements, the saw band is tightly stretched. Such saws are chiefly operated by individual motor drives, the electric motor

being located below the saw table and connected directly to the lower saw carrier.

Load in sawing, of course, depends upon the type of cut. In the sawmill, sawing is a heavy duty operation and the saw must be capable of withstanding high loads and severe shocks. In the woodworking plant, however, where socalled re-sawings or cut-off work is practiced conditions of operation are less severe. This, enables higher saw speeds.

MEANS OF LUBRICATION

Modern sawmill and woodworking machinery requires various types of lubrication according to the design of the moving parts and the duty which they perform. As a rule, some one of the following devices is applicable, viz.:

(a) The compression grease cup or pressure grease lubricator.
(b) The mechanical force feed oiler.
(c) The individual sight feed oil cup.
(d) The wick oiler, or
(e) Bath lubrication.

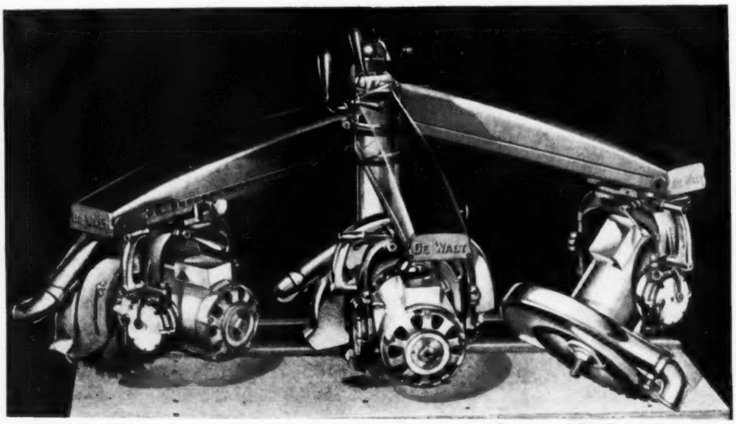
All can be readily applied to bearings; bath lubrication in addition is also used on gears and chain drives.

Pressure Lubrication by Grease

Grease lubrication is used chiefly on bearings. It dates back to the development of the compression cup. The later perfection of the pressure gun increased the dependability of grease lubrication; also improved its ability to protect bearing surfaces. When dealing with ball or roller bearings some builders still feel, however, that more accurate control of the amount of lubricant used can be attained by use of the hand-adjusted compression grease cup. This will be especially true where machine operators cannot be depended upon to handle a pressure gun with care.

On the other hand, there will frequently be greater possibility of grease becoming contaminated with non-lubricating or abrasive foreign materials when filling a compression grease cup than where a pressure gun is used. As a general rule, the cap of the former must be entirely removed and filled by hand by means of a spoon or paddle which is dipped into the grease container. Should the machine be operating at the time, there might easily be a possibility of dirt or sawdust gaining entry. Furthermore, there is no assurance at any time that the operator or mechanic will be sufficiently careful to prevent this.

Careless handling of lubricants may often affect a bearing adversely; in fact, as but a small amount of grease is applied to an anti-



Courtesy of The Fafnir Bearing Co.

Fig. 6—Phantom of a De Walt machine showing the versatility of the adjustment; this is facilitated by Fafnir ball bearing application.

friction bearing, it will not take very much non-lubricating foreign matter to do perhaps quite a considerable amount of harm. This is why the pressure grease gun is so often preferred even though accurate control of the amount of grease delivered may not be as easily attained. On the other hand, it is not difficult to study any type of such gun and develop an approximate idea as to the amount of grease discharged per second or per turn of the handle, according to the design. If this study is further extended to include approximate knowledge of the amount of grease required by the bearings according to their size, over-lubrication can be prevented to a great extent.

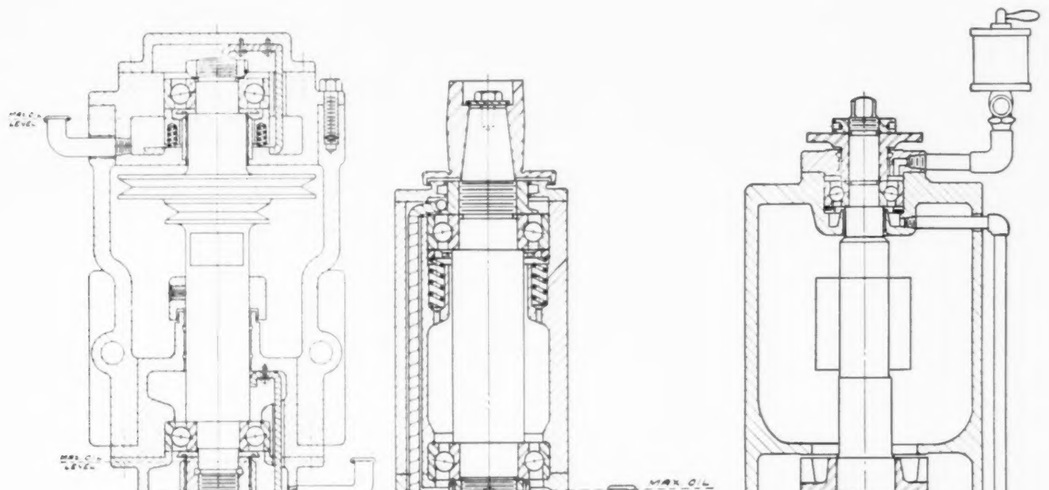
Fortunately, the ball or roller bearing only requires complete replenishment of lubricant about once every three or four months, or even less frequently if the housing is capable of holding a relatively large volume, and design and construction are such that an effective seal is maintained. Greases assist in the maintenance of such a seal and often prevent entry of dust, dirt and moisture more effectually than oils, so they protect the polished surfaces of the bearing elements in a very satisfactory manner. Greases can also be very much more effectively retained in a non-oil-tight housing. On the other hand dirt or grit which gets into a grease-lubricated bearing has no means of settling out; it is usually held in suspension and recirculated in contact with the rolling parts. This may cause wear.

The conditions under which ball or roller

bearings will operate in woodworking require that the grease used must show no tendency to separate in storage or when at rest in a bearing. Nor should this occur under moderate heating. There should be no constituent contained therein which might lead to hardening, breakdown, corrosion, pitting or rusting of bearing elements. This would prohibit the use of fillers, or the accidental entry of sand, resin, salts or abrasives of any nature whatsoever. There should be maximum resistance to oxidation, and no ingredients should be used in manufacture which might cause the lubricating film to become sticky, or to develop gummy residues.

matter which may have accumulated in the oil ways. It is particularly applicable to the travelling bed of the drum sander.

Wherever bearing ends are not sufficiently sealed to assure retention of oil, or where there is no provision for distribution of oil through the clearance spaces, other than by capillarity and the pumping action which is brought about by the rotation of the shaft or journal, force feed lubrication assures that clean, fresh oil is delivered to the bearings at periodic intervals. Some oil waste will always develop at the exposed ends of the bearings, but by proper timing and adjustment of the lubricator, the amount



Courtesy of Marlin-Rockwell Corp.

Fig. 7—Showing certain M-R-C designs of oil lubricated ball bearings for high-speed service. At the left is shown a wick feed application—the top and bottom bearings being in separate housings. The center view shows a unit housing with felt and a rotating flinger used to circulate the oil. At the right is shown a sight feed oil cup application with drain to prevent leakage at the shaft.

Finally, of course, the consistency involved should be suited to the operating requirements. Greases of a buttery or short fibrous nature will meet average operating conditions where the lubricant must cover the entire surfaces of the balls or rollers and resist channelling in the housings or around the retainers.

Pressure Lubrication by Oil

The mechanical force feed oiler is applicable to bearings in hazardous or inaccessible locations. It is a most positive means of assuring that oil will be delivered to a bearing or slide in about the right amount to maintain the necessary lubricating film, and under sufficient pressure to expel any contaminating foreign

will be so small and oftentimes so contaminated that its value will be comparatively negligible. If, in turn, pans are provided to catch any oil drip, comparative cleanliness will be assured. In this way oil spotting of wood will be prevented; the rubber cushions of endless bed drum sanders will be protected; and machine surroundings made safer for the workers.

The flexibility of the mechanical force feed oiler is clearly brought out by the duty which it is called upon to perform on the drum sander and rip saw. The former requires positive and accurately controlled lubrication. On the latter worm reduction gearing, the cast iron

links of the feed chain, and the ways or tracks over which this chain passes can all be served by one such lubricator, positively and with just the right amount of oil.

Care of the Lubricator

But little adjustment is required by a mechanical lubricator. Once it has been filled with oil and the respective oil outlets adjusted for delivery of the desired number of drops of oil per minute, no further attention will be required. This is especially true where such a device is driven directly from the machinery which it is to lubricate. Here it only operates or pumps when the machinery itself is in operation; starting or stopping of the latter automatically starting and stopping the respective pumps of the lubricator. The number of drops of oil delivered per minute through any of the outlets, will vary directly with the speed of the machine.

Design

The oil storage reservoir of the mechanical force feed oiler may hold several pints of oil, according to design. The pump, of piston or plunger type is located within this reservoir or attached thereto. It is provided with means whereby it can be attached to the machine to be lubricated or to an independent electric motor, through a ratchet, clutch or belt connection.

It is practicable to include quite a number of pumps in the one lubricator in order to enable lubrication of a considerable number of parts from the one drive. It is also practicable to divide the lubricator into two or more parts so that more than one grade of oil can be delivered by the same device.

An eccentric or a cam located within the oil reservoir operates the pumps. This device receives its motion through the exterior operating mechanism such as the ratchet. Each pumping unit can be designed to operate independently so that individual regulation is practicable by observation of the rate of flow through a sight feed attachment.

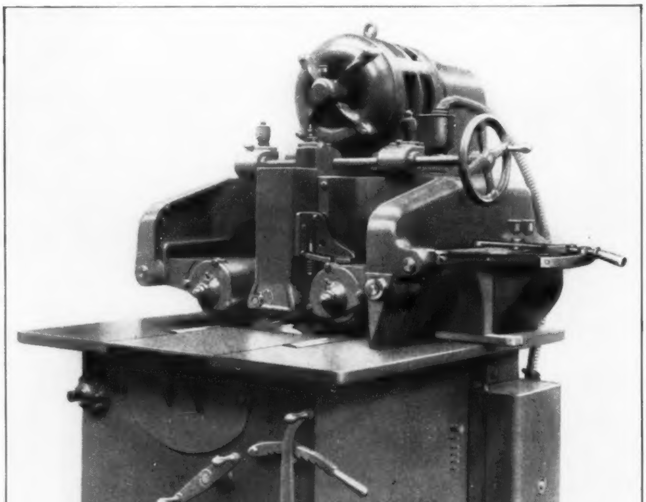
UNIT LUBRICATION

In many cases sleeve type bearings, however, can be most economically lubricated by sight feed oil cups, wick feed cups or bottle oilers. In principle they are similar to the mechanical force feed lubricator, in that they deliver fresh oil to the bearings more or less periodically, according to their design.

Only the sight feed oiler is adjustable by hand. In the others, the size of the orifice through which oil is allowed to pass to the bearings serves as a rough means of regulation. Where the orifice is comparatively large, and where the machine operator fills a cup full of oil without any thought as to the rapidity with which it will drain through the bearing, the latter may sometimes receive too much oil and waste may develop. The sight feed oil cup, on the other hand, is capable of more accurate adjustment of its oil flow. On many types, there are also provisions for actually stopping the oil flow. This is especially advantageous when a machine is to remain inactive for any length of time.

Wick Feed Oil Cups

These devices are useful in lubricating the types of bearings employed on high speed spindles. They provide for periodic application of oil to the bearings. On the shaper a small centrifugal pump, located in the lower oil reservoir, is frequently employed to feed oil to the upper ball bearing via a suitable wick. From here, the oil drains to the lower bearing reservoir to be distributed by a smaller wick. After passing through this bearing the oil returns to the sump.

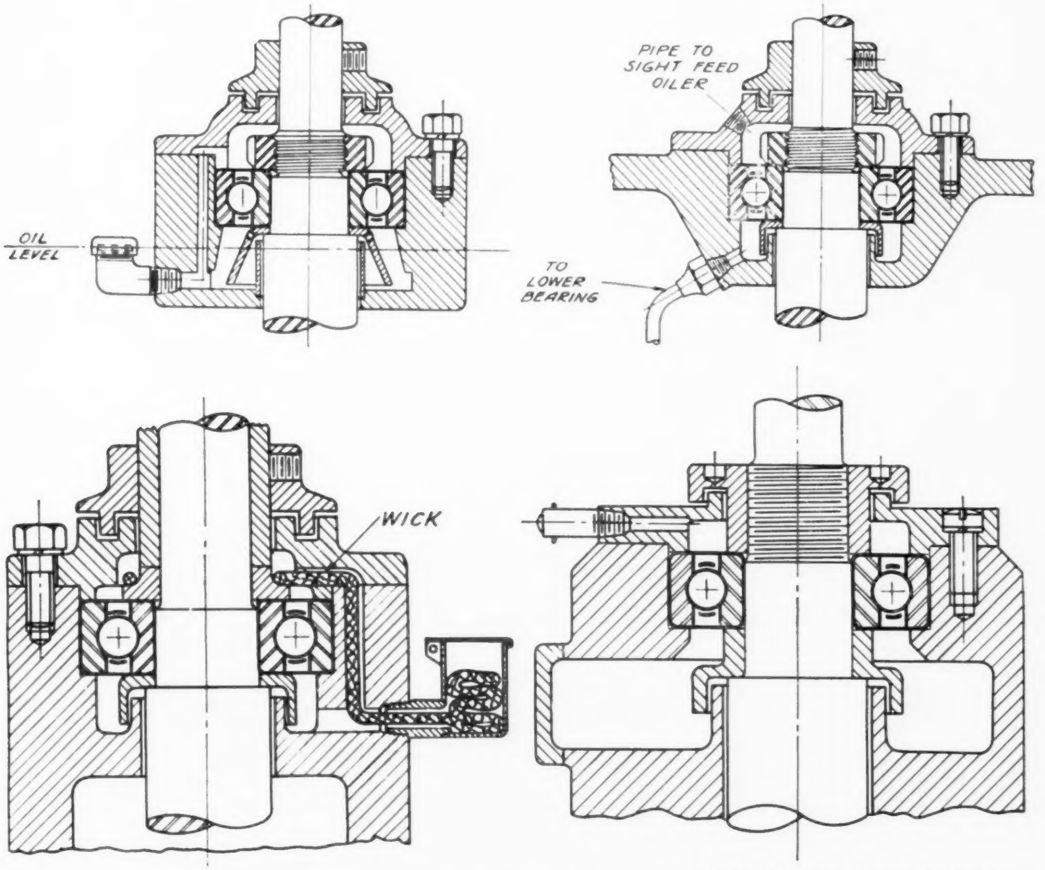


Courtesy of Yates-American Machine Co.

Fig. 8—A Yates-American G-50 ripsaw showing lubrication fittings at lower right, below the bed.

In service the wick acts as a filter; therefore, wick feed lubrication assures that clean oil is continually delivered to the bearings. In addition, the oil feed is practically automatic. However, this will not hold true over the entire life of the wick, because during continued operation, should there by any possibility of entry of dust or dirt into the lubricating oil, the wick will naturally accumulate this more and more until ultimately it may become so clogged as to prevent ready flow of oil through the moisture in the wick impedes free flowing of oil. So, after cleaning, or when installing new wicks, they should be dried and thoroughly saturated with oil prior to usage in order to displace any possible moisture content.

Wick feed lubricators can also be designed to employ the action of the siphon, giving a combination of both capillary and siphonic action. Capillary action is involved in the upfeed type of lubricator, wherein the oil passes upward through the strands of the wick of its



Courtesy of Norma-Hoffmann Bearings Corp.

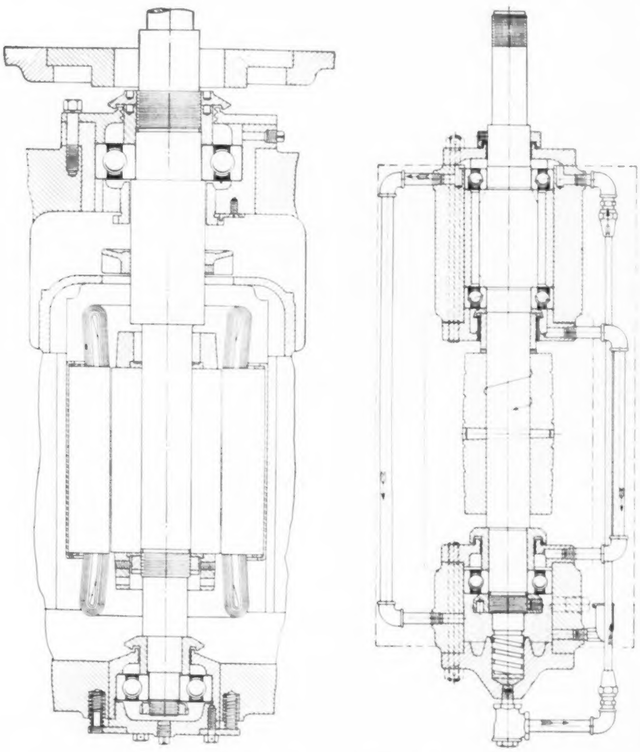
Fig. 9—An assembly of Norma-Hoffmann vertical ball-bearing spindle mountings for woodworking machinery. The bearing at the upper left carries both thrust and radial load, it is oil lubricated. At the top right is shown another type of oil circulation device. The lower left involves wick feed application of oil, in contrast to the grease-lubricated assembly at the lower right.

strands. Hence, the advisability of removing and cleaning the wicks at regular intervals.

Flow of oil may also be influenced by the number of strands composing the wick for this will affect capillary action. If there are too many strands, or if the wick is too heavy or tightly woven, capillarity may be reduced. Excessive moisture may also affect this action. New wicks especially will tend to absorb moisture when exposed to the air. This is detrimental to capillary action inasmuch as own accord, motion of the journal or shaft being required to draw oil away from the uppermost part of the wick with which it is in contact.

Capillary type wicks are automatic, even without a pumping element, for the flow of oil automatically starts and stops with the starting and stopping of the rotating element. Siphon type wicks, however, or those devices which involve both capillary attraction and the action of the siphon, must have some provision

for starting or stopping the flow of oil. Otherwise, this latter will continue whether or not the shaft or journal is in motion.



Courtesy of New Departure Division General Motors Sales Corp.

Fig. 10—Showing New Departure designs for oil and grease lubricated spindle bearings. The latter is shown at the left. At the right is a high speed shaper spindle with a built-in oiling system. Arrows indicate path of oil circulation.

MASS PRODUCTION CONTINGENT UPON LUBRICATION

Positive operation must be assured, for mass production in the woodworking industry has come to be virtually a by-word, and the custom in every phase of operation. Grease is especially adaptable where operation in various planes may be required. The swing saw would be illustrative of this condition. It is obvious that where oil is used on such bearings there may be a possibility of inadequate lubrication, when the bearings are located in certain positions due to the oil level falling below the circulating element.

Where such bearings are designed to operate in a fixed plane, however, oil lubrication by means of wick circulation has proven quite positive and satisfactory. It is easier to control the amount of lubricant in such a bearing where oil is used than where grease is employed. This can be brought about by means of an accessory oil cup—which renders it virtually impossible to raise the oil level above the top of the cup, due to the overflow tendency. An overflow or oil level control is especially desirable where wick feed lubrication may be involved, for it will prevent any possibility of abnormal oil leakage from the bearing.

Every precaution is taken today by the users of anti-friction bearings to prevent loss of lubricant by leakage. This can be accomplished by the employment of grooving or by the use of suitable felt washers or other sealing media. This construction, of course, will also serve to prevent entry of contaminating or abrasive foreign substances. Grease, as a rule, will serve as a more effective bearing seal than oil. As stated, however, grease will tend to retain non-lubricating foreign matter to a considerable degree, although this will, of course, depend upon the consistency of the grease and the efficacy of the seal.

FLOOD LUBRICATION OF GEARS AND BEARINGS

Gears which are located in an oil-tight housing can be operated in a bath of lubricant. This means that the teeth can be constantly protected by an adequate film of lubricant of the proper viscosity to prevent wear and noise as far as possible. Furthermore, but very little attention will be required. In fact, such an installation is comparable to the driving gears of an automobile wherein, provided that the proper lubricant is originally chosen, continued and efficient operation can be depended upon for extended periods of time. The use of an oil-tight gear case is also conducive to cleanliness and to protection of the lubricant against contamination by sawdust or other non-lubricating foreign matter.

The viscosity or body of the lubricant will depend upon the loads which must be carried by the gears. A comparatively thick lubricating film is often conducive to best protection of the tooth surfaces though it should not be so adhesive as to develop abnormal drag; this would increase the power consumption, especially on starting or when operating under comparatively low temperature conditions.

Noise is often a measure of effective gear lubrication. Excessive noise can usually be taken as indicating that faulty lubrication exists. Temperature is also a factor though it is almost impossible to use the temperature of the gear case as a criterion, as is practicable where bearings are involved. With these latter any development of abnormal metal-to-metal

contact will frequently be indicated by an increase in temperature which can oftentimes be felt by hand. In a gear case, however, there is so much more space available that any heat which might be developed through actual metallic contact between gear teeth would probably be dissipated before it has a chance to raise the temperature of the case.

Courtesy of Yates-American Machine Co.

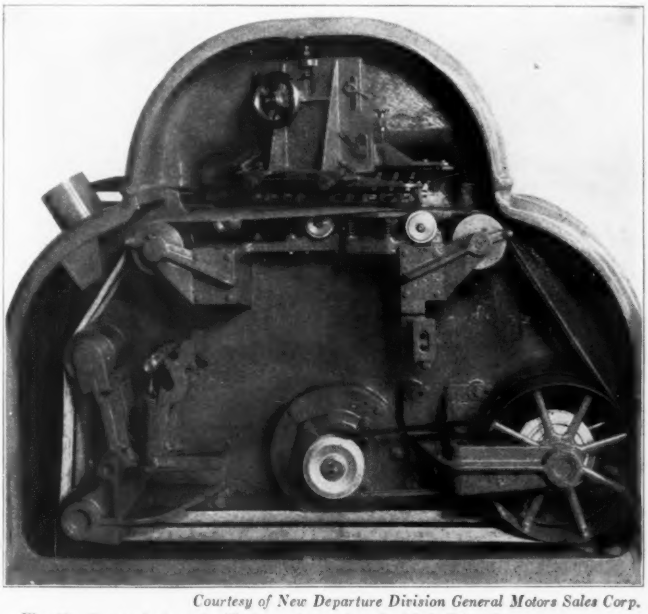
Fig. 11—Front view of a Sander showing oil pump (in foreground) which serves to lubricate the bed ways.

Whenever wear may be suspected, or noise may indicate faulty lubrication, the gear case should be opened and all used lubricant removed, the teeth being cleaned as far as possible with a comparatively light machine oil or flushing oil. Then the extent to which wear has been occurring can be observed. If this has not gone too far, the next step would be merely to add a fresh charge of gear lubricant and proceed with the operation. Generally speaking, however, even though there is no indication of excessive noise, it will be advisable where a machine has been in continued operation comparatively steadily, to clean out gear cases about twice a year, especially if sawdust may have a chance to penetrate and reduce the lubricating ability of the gear lubricant.

Exposed Conditions

Where gears are exposed, the problem of protecting the wearing surfaces of the teeth may become more difficult; it will depend, however, upon the location of the gears and whether they constitute a feed, drive or adjusting mechanism. The essential factor is to select a lubricant which will adhere tenaciously to the teeth and resist the throwing-off effects of centrifugal force. On certain types of woodworking machinery, however, the matter of sawdust must be taken into account. Sawdust, of course, is not abrasive, but it is non-lubricating. If, therefore, it has a chance to become mixed with certain types of gear lubricants, these latter, by virtue of their retentive ability, will accumulate so much sawdust as to cause balling-up. The normal consequence will be a congested condition which may extend to the bearings to subsequently hamper their lubrication as well.

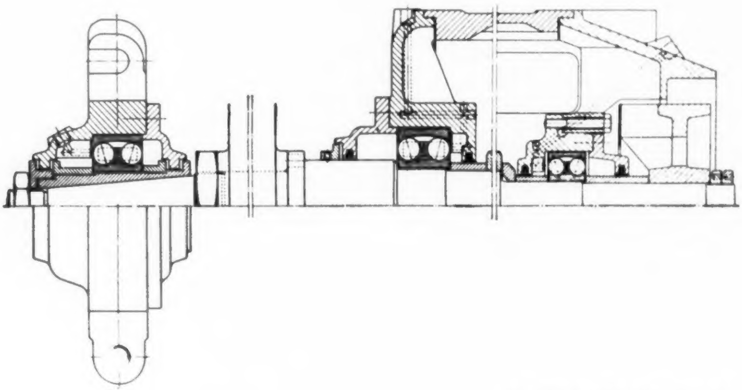
It is for this reason that the more adhesive types of strictly gear lubricants are not always as satisfactory for such gears, as are those more fluid machine oils which can serve to keep the gear elements free from accumulation of sawdust by virtue of their washing action.



Courtesy of New Departure Division General Motors Sales Corp.

Fig. 12—Exposed view of a Nash sander equipped with ball bearings.

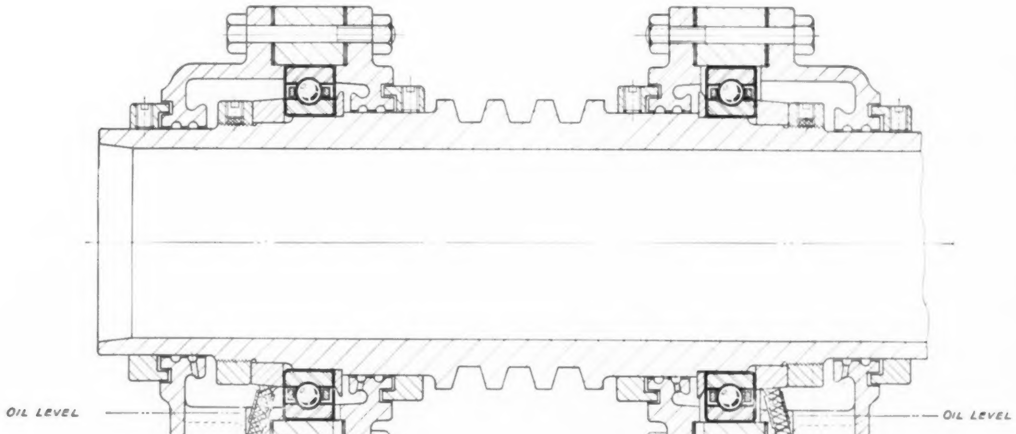
This latter action, however, will involve the necessity of suitable drip pans in order to prevent sloppy and hazardous conditions around the machine. It is difficult to practice oil essential of continuous production. Fortunately, the gears whereon such means of lubrication may be necessary are of comparatively small size, and not subjected to appreciably



Courtesy of SKF Industries, Inc.

Fig. 13—Details of an SKF ball bearing application to a planer.

economy where lubricant is used in this manner. On the other hand, oil economy, while important, must frequently give way to machine protection and the more outstanding severe loads or shocks during operation. In many cases, they have the added advantage of intermittent operation.



Courtesy of Norma-Hoffmann Bearings Corp.

Fig. 14—A special high speed spindle on a lathe headstock equipped with large bore extra light series ball bearings. To avoid excessive churning and heating of oil with possible loss, the oil level is kept well below the lowermost moving parts. Wick feed provides for adequate oil circulation to the bearings, the returns carrying the oil back to the sumps in each bearing cap. Labyrinth slingers prevent entry of foreign matter.

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LUBRICATION OF WOODWORKING MACHINERY

BEARING LUBRICATION
As Involved on Band Saws, Planers, Shapers, Surfacers, Matchers, Moulders, etc.

PLAIN OR SLEEVE TYPE BEARINGS	
Drip Lubricated	
By Wick Feed or Sight Feed Oil Cup	Texaco Nabob or Aleph Oil or Texaco Altair Oil
Pressure Oiled By Mechanical Force Feed Oiler	Texaco Regal Oils Texaco Aleph Oil or Texaco Altair Oil
BALL AND ROLLER BEARINGS	
Oil Lubricated	Texaco Rabtex, Capella or Cetus Oil
Grease Lubricated High Speed Ball Bearings	Texaco Starfak Grease No. 00, No. 2 or No. 3

SLIDES OR WAYS
As Involved on Rip Saws and Drum Sanders

PRESSURE OILED	
By Mechanical Force Feed Oiler	Texaco Regal Oils Texaco Aleph Oil or Texaco Altair Oil

GEARS

HIGH SPEED DRIVING GEARS	
Bath Lubricated	Texaco Marfak No. 0, No. 1 or No. 2
FEED GEARS AND OTHER SPEED REDUCTION ELEMENTS	
Drip Oiled	Texaco Thuban 90, 629 Oil or Texaco Altair Oil
WORM REDUCTION GEARS	
Pressure Lubricated	Texaco Aleph Oil or Texaco Altair Oil
Bath Lubricated	Texaco Cavis Cylinder Oil or Texaco 650 T Cylinder Oil

DRIVING CHAINS
As Employed on Multiple Drills, Planers, and in Connection with Other Power Transmission Elements

DRIP OR WICK OILED	Texaco Aleph Oil or Texaco Altair Oil
GREASE LUBRICATED	Texaco Hytex Grease No. 3 Texaco Star H Greases, or Texaco Starfak Grease No. 0, No. 2 or No. 3

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